

Analysis of the Video from the 9-30-2008 Fullerton, CA Cessna 172S Crash (LAX08FA301)

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Three cameras (video channels 10, 11 and 12), mounted on roof of the second floor of the control tower, captured images of the aircraft. Since the tower was about 500 ft from the runway and the three cameras were close to each other, the cameras did not provide views from different angles that could be used for triangulation and accurate estimation of aircraft orientation. A map of the airport, location of the tower and the point where the aircraft impacted the runway are shown in Figure 1.



Figure 1 Fullerton Municipal Airport

Each video channel was recorded at the rate of 1 frame per second. Camera 10 captured 3 images of the aircraft, at times 6:37:36, 6:37:37 and 6:37:38. Camera 11 captured six clear images of the airborne aircraft between times 6:37:34 and 6:37:39. Three of these images were virtually equivalent to those captured by camera 10. Camera 12 was oriented west of cameras 10 and 11 and it captured two images of the aircraft just before the crash, at times 6:37:41 and 6:37:42. The image at time 6:37:43 and later images show the crash site after the aircraft impacted the ground.

Using measurements from video frames between times 6:37:35 and 6:37:39, acquired by cameras 10 and 11, it was estimated that the speed of the airborne aircraft was 82 ± 4

knots. During this time interval, the aircraft was still climbing and its roll and pitch angles were small.

Because the aircraft was about 500 ft from the cameras, the resolution of the aircraft images is low. Figure 2 shows a close-up of the aircraft from the image recorded by camera 12 at time 6:37:41. Figure 3 shows a close-up from the image recorded by camera 12 at time 6:37:42.



Figure 2 Aircraft at Time 6:37:41 – Camera 12



Figure 3 Aircraft at Time 6:37:42 – Camera 12

Figures 2 and 3 do not have sufficient resolution for determining the flap settings. Images acquired by cameras 10 and 11 have the same low resolution and, therefore, flap settings cannot be determined based on the video from the three cameras.

The low video frame rate of 1 frame per second limits the accuracy with which the orientation of the aircraft at the time of ground impact can be estimated. The 6:37:41 image from camera 12 shows the aircraft sometime between 1.5 and 2.0 seconds before ground impact and the 6:37:42 image shows it sometime between 0.5 and 1.0 second before impact. There is no image available that shows the aircraft at or just before the impact. The image at time 6:37:43 shows the scene after ground impact.

At time 6:37:41 (see Figure 2), the aircraft still has a relatively small pitch angle but its roll angle seems to be already about 45° . At time 6:37:42 (see Figure 3), the roll angle is about 75° and the longitudinal (X) body axis is beginning to point down from horizontal. To determine the orientation of the aircraft at time of impact, one has to rely on extrapolation based on Figures 2 and 3, on the damage to the aircraft, on the statement of eyewitness Thadeuss Perkins, and on the interview with the pilot.

A photograph of the damaged aircraft is in Figure 4. It shows that most of the ground impact was absorbed by the nose because the wings are still relatively intact and attached perpendicularly to the fuselage. This means that the aircraft hit the ground with no more than about 20° yaw attitude.



Figure 4 The Damaged Aircraft

The statement by eyewitness Thadeuss Perkins supports this conclusion when he states that *“Then I saw the right wing strike the runway as the nose of the Cessna seemed to be perpendicular with the runway. Then the nose of the Cessna struck the runway in a cartwheel motion”*. The pilot stated that *“the plane finally did go to the right and then nosed over and went right back down”*, also supporting the nose-down impact theory.

There is insufficient video evidence for estimating the speed of ground impact accurately. Figures 2 and 3 and the pilot interview indicate that the aircraft was turning right relative to the runway during the last 2 seconds of flight. That direction is away from the cameras and, therefore, the aircraft velocity component to the right (perpendicular to the runway) could not be estimated. The average velocity component along the runway between times 6:37:41 and 6:37:42 was estimated to be 39 knots. Since, as seen in Figures 2 and 3, the turn to the right during that second was significant, the velocity component perpendicular to the runway at 6:37:42 was significant, possibly resulting in airspeed as high as 70 knots.

The last fraction of a second, from 6:37:42 till impact, is difficult to analyze. The aircraft flies away from the camera with a roll angle close to 90°, its fuselage rotates about 50° in the yaw direction, then the right wing tip hits the ground, the aircraft cartwheels about that contact point with the ground, and the nose impacts the ground. It is not possible to estimate accurately the speed with which the nose impacted the ground. It was probably somewhere in the 40 to 70 knots range.

Conclusions

Only two video frames, shown in Figures 2 and 3, captured the aircraft as it was crashing. These two frames were acquired from a distance of about 500 ft, they are spaced by one second, and in the second frame the aircraft is flying away from the camera. Consequently, the information that can be extracted from these frames is limited and the accuracy with which ground impact speed can be estimated is low.

Summary of Estimated Quantities:

Airspeed at Impact	40 to 70 knots
Pitch Attitude at Impact	90°±15°
Roll Attitude at Impact	90°±15°
Yaw Attitude at Impact	-20°±10°
Flight Path at Impact	Longitudinal (X) body axis within about 20° from vertical, right wing tip hitting ground first, then the nose hitting ground, finally aircraft coming to rest upside down
Flap Settings	Cannot be estimated